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THE MIAMI CONSERVANCY BULLETIN

MARCH, 1921

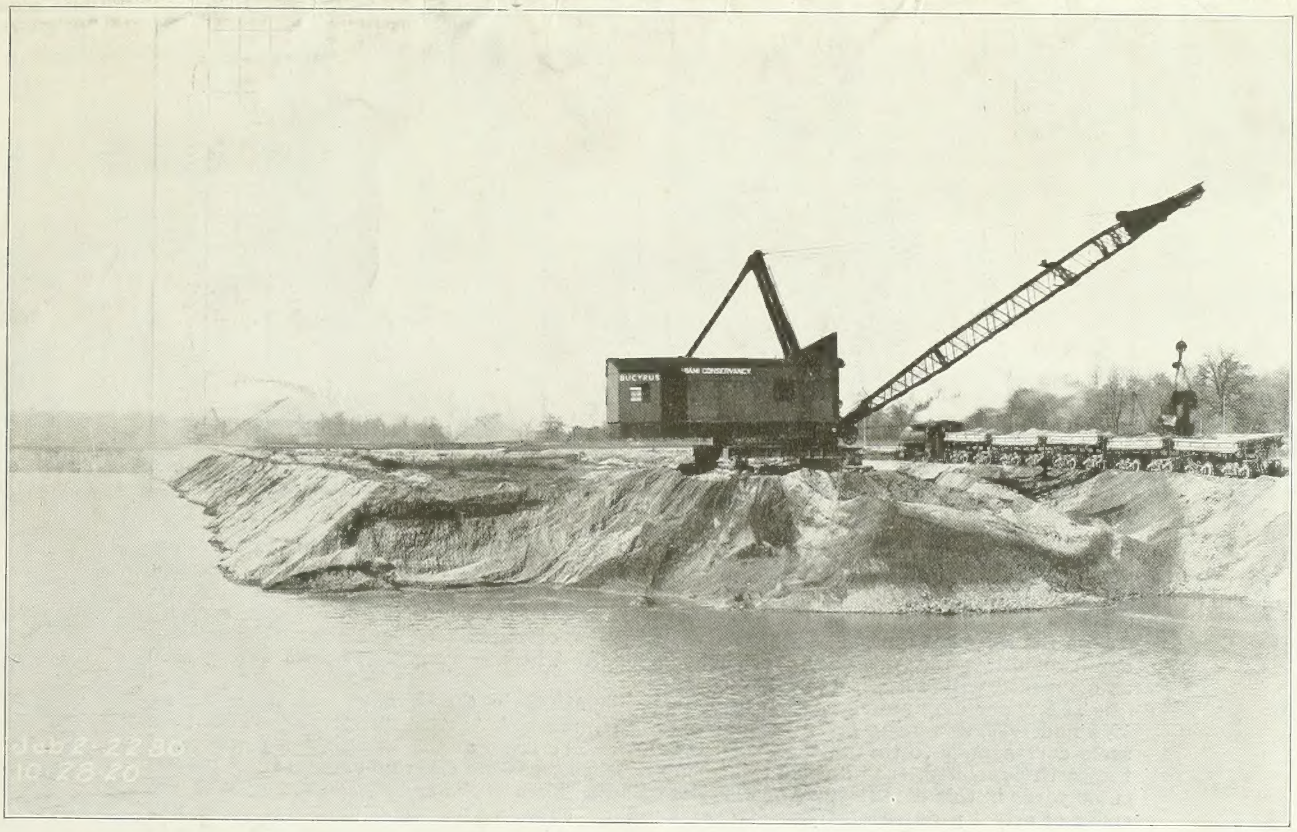

FIG. 273—DRAGLINE EXCAVATOR DIGGING MATERIAL IN ENGLEWOOD BORROW PIT, OCT. 28, 1920

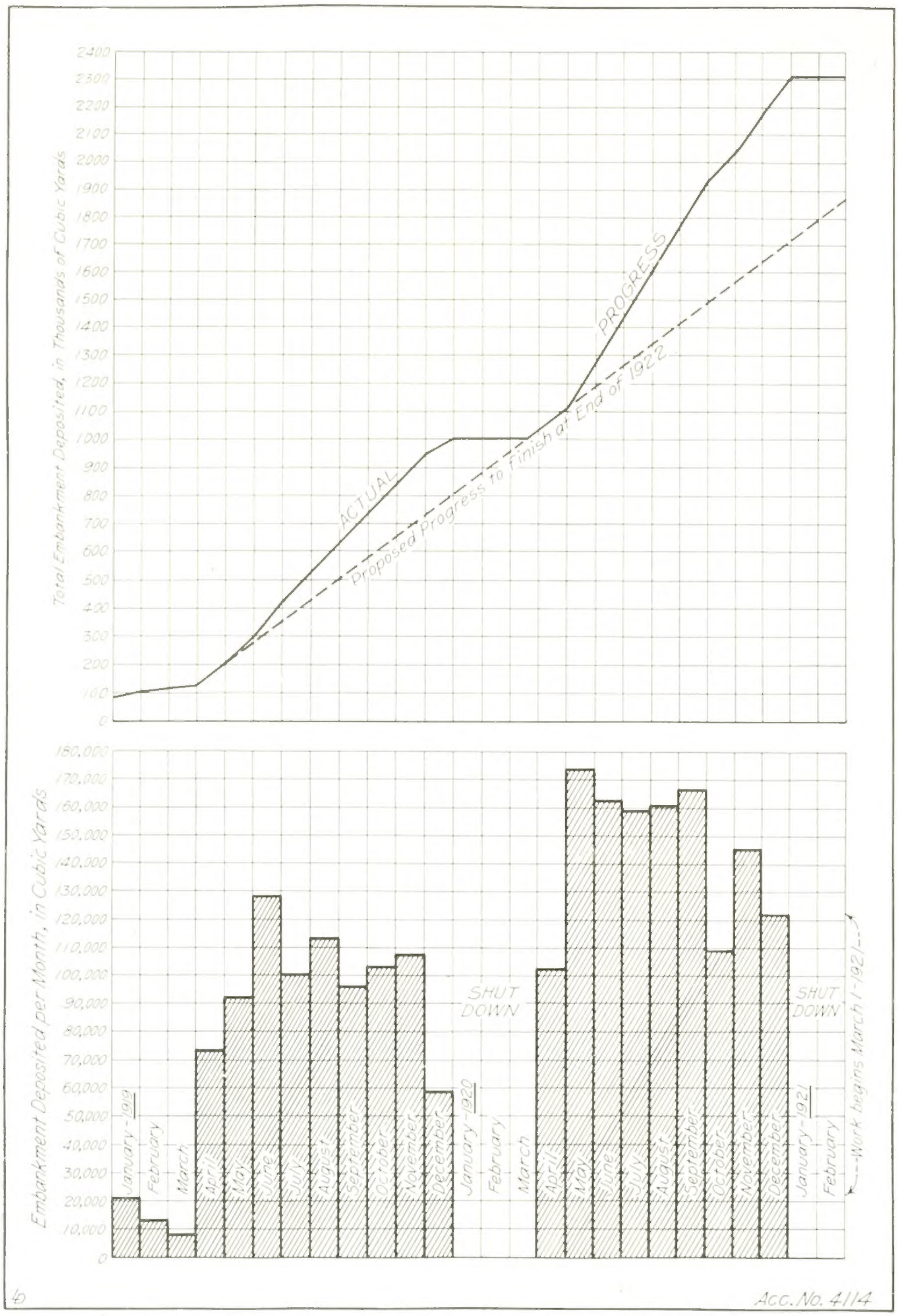

FIG. 274—DIAGRAMS OF PROGRESS, ENGLEWOOD DAM EMBANKMENT

The lower diagram shows the amount of earth deposited in the embankment each month during 1919 and 1920, each vertical shaded rectangle representing one month's work. The height of the rectangle is proportional to the quantity of earth deposited. A scale for approximate measurement is shown at the left, each horizontal space running across the diagram representing 10,000 cubic yards of earth. (A cubic yard being just about an old-fashioned dump-board wagon load). The more rapid progress during 1920 as compared with 1919, is evident.

The upper diagram shows the total earth deposited in the dam at any date, during 1919 and 1920, this being given by the upper line, marked "actual progress." The time scale corresponds to that in the diagram below. The scale at the left gives a measure of the earth deposited, each horizontal space running across the diagram representing 100,000 cubic yards in this case (instead of 10,000 as below). Thus at the end of December, 1919, the curve of actual progress had just reached a million cubic yards. The dotted straight line represents the line of proposed progress as given by the schedule laid down originally, to complete the dam at the end of 1922. Note that during 1919, including the three months' shutdown made necessary by the cold weather of the winter of 1920, the actual progress was just up to this proposed schedule. During 1920, however, the curve of actual progress rises much more sharply, and ends, even including the winter shutdown (two months long this time), far above the line of proposed progress. Work began in 1921 on March 1.

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Index

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G. L. TEEPLE, Assistant Engineer, EDITOR.

Building of Dam Embankments Resumed After Winter Shutdown

The pumping of earth materials into the various dam embankments was stopped, except at Huffman, at the end of 1920, to permit an overhauling of the machinery and equipment for the active work of the coming season, and also because during the cold weather of the winter months this work cannot usually be carried on at highest effiency. At Huffman the work was continued owing to the desirability of pushing the embankment above the danger of overtopping by spring floods. At the other dams the embankments were at a height sufficient to render them already safe in this regard.

The winter has been so mild and open that the cold weather shutdown has been much shorter than it was a year ago, pumping being resumed at Taylorsville on February 25, and at Englewood and Lockington on March 1. At Taylorsville the materials are being pumped into the section west of the river, the same as last year. The river section will be begun later in the season, after the river has been turned into the new channel through the new outlet works, the downstream portion of this new channel being now in process of excavation. At Englewood the materials are being pumped into the river section. The west section (west of the temporary spillway), will be started a little later in the season, and pushed at the same time as the other two. At Huffman work has proceeded during the favorable weather of the winter almost as fast as during the regular season. During the coming season materials at Huffman will be pumped from both the hillside and valley bottom borrow pit, the upper levels of the former having now been exhausted so that gravity flow alone will no longer carry the materials into the dam embankment. At Lockington the pumping begins with the dam embankment only 20 feet from the summit, so that the topping out of the dam will be finished early in the present season. At Germantown the stripping of the camp and the dismantling of the machinery and equipment, following the completion of the dam, have been brought practically to an end.

Interesting New Work Up and Down the River

Several interesting pieces of work in the smaller cities along the river are on the program for the coming season. One is the building of the flood gates for the hydraulic canal and for the tailrace of the American Writing Paper Company at Franklin. Excavation for the tailrace conduits has already begun, this work being done by the dragline excavator which dug the gravel material for the Taylorsville conduits (a Class 14 Bucyrus steam machine). The work at Franklin will be the subject of an early illustrated article in the Bulletin.

At Troy the chief interest is perhaps in the new bridge work. This includes a new steel span for the Market Street bridge, and work on the new concrete bridge at Adams Street. The excavation for the north abutment of the new steel span is under way and the steel has been ordered. Gravel and lumber for the abutment is on hand. The Adams Street bridge, which will cost approximately $350,000, and which will be of the same general type

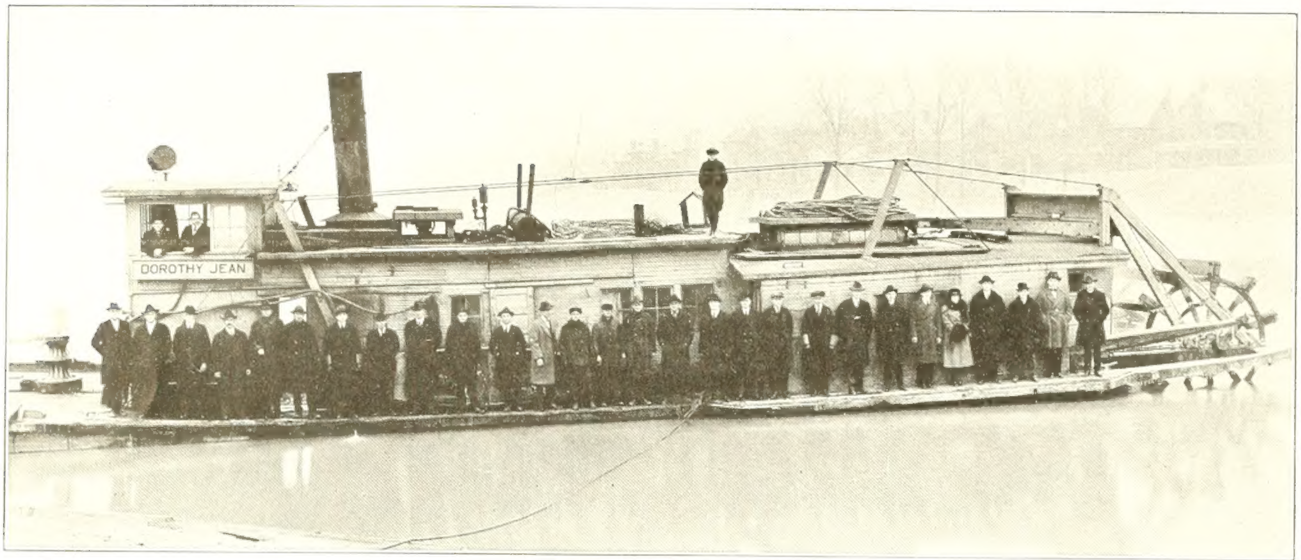

FIG. 275—THE PASSING OF THE DOROTHY JEAN. DEC. 10, 1920.

as the Black Street bridge in Hamilton, described in our last issue, will be begun later in the season. An article on this bridge is in preparation and will be presented in a later number.

The Passing of the Dorothy Jean

An unusual local interest attaches to the picture on this page, Fig. 275, because it marks the passing of the first, and last, steamboat which has ever run on the waters of the Miami River. She was built to transport materials excavated to make the improved river channel through Dayton, the material being loaded upon scows instead of dump car trains as at Hamilton, river conditions making the use of trains along the banks in Dayton uneconomical. She was built in the period between October, 1918, and February, 1919, in the Conservancy "shipyard" near Herman Avenue bridge, and took her maiden voyage February 27. She was of the usual sternwheel Ohio River model, 70 feet in length by 20 feet beam, and drew about 2 feet of water. She was equipped with a pair of Barnes engines, 8 inch by 42 inch, developing 125 horse power. Her original boiler was of the locomotive type, built for 150 pounds pressure, but this proved insufficient, and was replaced by a Scotch marine type boiler, 66 inch by 117 inch, built for 175 pounds pressure. The scows she pushed were 40 feet by 120 feet by about 6 feet deep, taking a load of about 250 cubic yards, and drawing, thus loaded, about 5 feet of water. The usual summer flow of the Miami did not provide this depth, so that a low timber dam was built across the river just above Third Street, which raised the level there about 4 feet. The surplus material between Fifth and Washington Streets will be more easily transported by dump car train than by scow. Hence the work of the Dorothy Jean was discontinued with the end of 1920. She transported a total of half a million cubic yards of material.

The Character of the Engineer

The following, quoted from the ancient Roman engineer and architect, Vitruvius, shows that the ultimate foundation of an engineering work in the character of him who builds it, was a truth as well understood then as now.

"Moral philosophy will teach the engineer to be above meanness in his dealings and to avoid arrogance. It will make him just, compliant, and faithful to his employer, and what is of the highest importance, it will prevent avarice gaining an ascendency over him, for he should not be occupied with the thought of filling his coffers nor a desire of grasping everything in the shape of gain, but by gravity of his manners and a good character should be careful to preserve his dignity."

Review of Conservancy Technical Reports, Part VII

By Ivan E. Houk

Hydraulics of the Miami Flood Control Project—By Sherman M. Woodward, M. Am. Soc. C. E., M. Am. Soc. M. E., Consulting Engineer of the District, Professor of Mechanics and Hydraulics, State University of Iowa. Technical Report, Part VII, The Miami Conservancy District, Dayton, Ohio. Paper; 6x9 inches, 344 pages, 126 illustrations, index. $1.00.

This volume is the seventh of the Technical Reports issued in connection with the planning and execution of the notable system of flood protection works now being built in the Miami Valley. These works, which will cost approximately $35,000,000 and which are rapidly approaching completion, consist of five large earth dams, forming retarding basins, and numerous channel improvements in the larger cities and villages. The present volume discusses in a comprehensive manner, first, the considerations which led to the adoption of the retarding basin plan; and second, the numerous hydraulic problems entering into the design of the works. No matters referring solely to structural design are included.

The material has been arranged in a clear, logical manner, without reference to the actual chronological order of development. A considerable part of the hydraulic matter, so far as is known, has never been worked out or published before. Other portions have been presented previously, in more or less similar form, in scattered and fugitive publica-

(Continued on Page 128)

Englewood Dam Embankment Pushed Rapidly in 1920

Earth Totalling 1,300,000 Cubic Yards Placed During the Season. Only 1,200,000 Cubic Yards Now Remain To Be Done.

Pictures in the Bulletin for November, 1920, showed something of the rapidity with which the Englewood dam embankment was carried up during the season of 1920. The diagrams in the present issue tell the story of embankment building in greater detail, and over a period carried back to the beginning of the work in the summer of 1918.

To understand the progress made at Englewood, a brief outline of the construction program is necessary, especially that relating to what is known as "stream control; that is, the provision made for the safe passage of the river around and under the dam during construction. This is of prime importance during flood seasons, when the river rising might overtop the unfinished dam embankment, which, being of earth, might thus be swept away or seriously injured. The worst floods coming in winter and early spring, the general endeavor is to push the work of embankment building as rapidly as possible during the season following the spring flood, so that the crest of the dam may by winter be carried above flood level. At Englewood, however, the great width of the Stillwater valley makes the dam so long (4,660 feet), that its entire length cannot be carried up to a safe elevation in a single season. As a result, the dam has to be built in sections, one after the other, each being carried up so rapidly, during a single summer season, that by winter the working section may be above the danger point.

At Englewood these sections are three in number. The first extends from the east river bank eastward. The second occupies the old river bed. The third extends from the west river bank westward. These sections are being built in the order named; the first in 1919; the second in 1920, and the third in 1921. The ordinary river flow during all three seasons is being carried by the dam conduits, these having been built before the work of embankment building seriously began, and being the same which will carry the river under the dam after its completion. In case of flood during construction, however, the division of the dam into sections permits the river to pass not only through the conduits, but through much ampler channels in addition—through the old river bed during 1919, and through a "temporary spillway" (dug on the valley floor just west of the old river bed), during the seasons of 1920 and 1921. The carrying up of all three sections of the dam to final elevation, after pushing them up consecutively to safety in the manner described, will be done simultaneously, during the latter part of 1921 and the season of 1922.

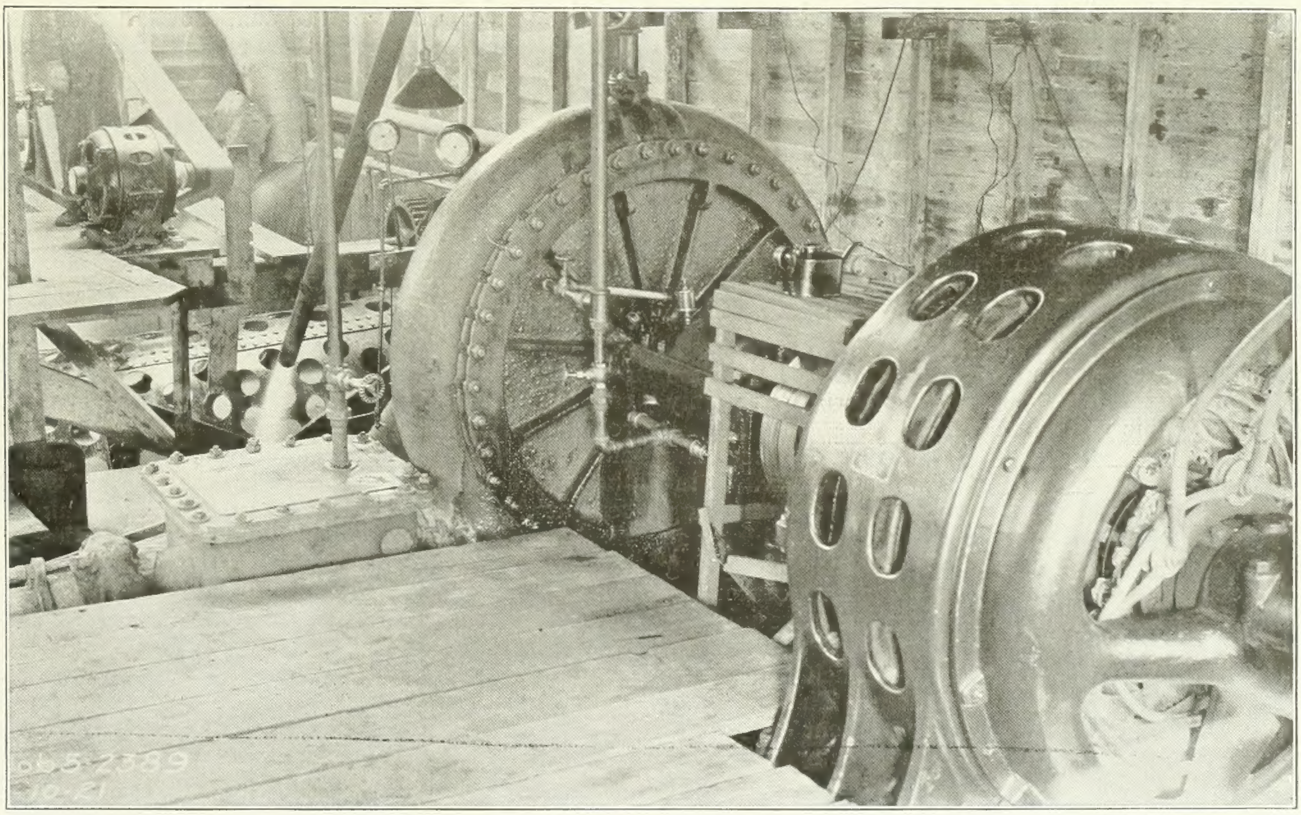

FIG. 276—DREDGE PUMP WORKING AT HUFFMAN DAM, JAN. 10, 1921

This is an "Amsco" centrifugal pump, of 7,000 gallons per minute nominal capacity, and working up to 150 feet head. It is driven by the 350 horse Allis Chalmers electric motor seen at the right, both being mounted on the same shaft. The pumps and motors at Englewood are similar machines to these, except that the motors are of 500 horse power in order to pump to the greater height of the Englewood dam. The electric lamp shade hanging just beyond will give a rough scale of size. See page 118.

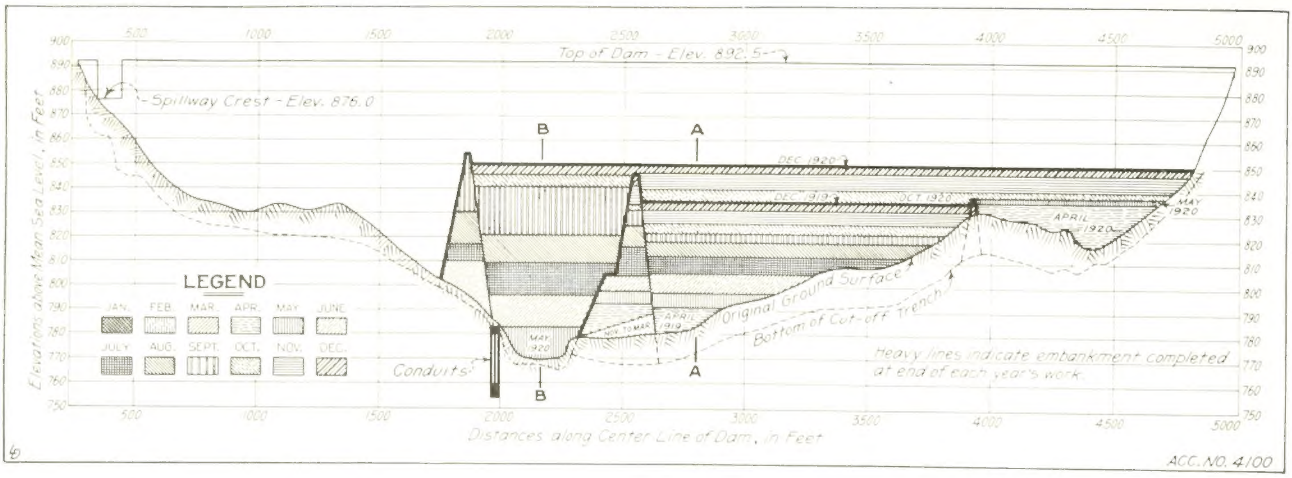

FIG. 277—LONGITUDINAL SECTION, ENGLEWOOD DAM, SHOWING PROGRESS

These facts are brought out in Fig. 277, which is a section of the Stillwater valley taken on the dam center line (the vertical distances being much exaggerated to bring out the desired features more plainly). The hatched line below is the original ground surface; the upper heavy line is the top of the dam when completed (in 1922). BB is the river section, the old river bed being the sag in the ground line just above the lower B. The sharp spurs rising on each side of the river bed represent very high levees built on the two river banks and crossing the damsite. They are known as cross dams or cross levees, and separate the dam into the three sections above referred to—the east section to the right of the right levee; the west section to the left of the left levee; with th river section between.

The shaded portions of the figure represent the parts of the dam already built, each season's work (that of 1919 and 1920), being bounded above and to the left by very heavy lines. The various cross hatchings are to indicate the work done in successive months, the key to this scheme being shown in the lower left corner. The portion of the diagram left blank between the heavy line marking the top of the completed dam, and the ground line and shaded portions below, represents the part of the dam embankment still to be done, comprising roughly 1,200,000 cubic yards of earth.

In carrying out the program just outlined, the work of the season of 1918 was preparatory. It included work on the concrete conduits; the stripping of the top soil from the dam site, to be used later as a top covering for the completed dam; the digging of a deep "cut-off trench" along the dam centerline, to be later filled with impervious clay material; and the laying of a 3-foot thick impervious "blanket" of clay extending from the cut-off trench to the upstream "toe" or limit of the dam. The object of both the last operations was to prevent seepage of backwater underneath the dam in times of flood. The east section of the dam being first on the program, the operations of cut-off trenching and laying of the impervious blanket during 1918 were confined to this section. At this time also the east cross levee was begun.

The building of the cross levee was necessary on account of the method of dam construction used—the method of "hydraulic fill," described in the Bulletin for February, 1920. This method involves the carrying of a pool of water along the centerline of the dam summit, mud deposited on the bottom of this pool forming the central core of clay material which makes the structure impervious. The cross levee, built along the east river bank crossing the dam site, was to enclose the west end of this pool, enabling it to be carried high above the river bed.

These preliminary operations being completed, the real work of embankment building began on April 1, 1919. The general method is to dig the material from the valley bottom above the dam by means of big steel buckets of "dragline excavator" machines, the buckets dumping into cars which transport the material to the north slope of the dam. Here it is dumped into a "hogbox," from which it is washed by water jets into a concrete "sump" or cistern, whence in turn it is pumped, mixed with much water, by powerful "dredge pumps" through pipes to the top of the dam, where it is deposited on the beaches and bottom of the pool. The water runs back to the "sump" by an overflow pipe running down from the pool surface.

One of the dragline excavators is shown in Fig. 273, with its boom projecting over the train of dump cars being loaded, its bucket hanging from the boom end after dumping its load. The machine runs on rollers, on which it "crawfishes" backwards very slowly up the valley, parallel to the track on which the train stands and to the bank of the pool of water seen at the left, and digging as it goes the bank behind it (the bank between the machine and the observer). The entire upper part of the machine, carrying the boom and bucket, swings on its center, to permit the loaded bucket to be dumped into the cars on the track.

One of the large "dredge pumps" for pumping the mixed earth and water to the top of the dam is shown in Fig. 276, coupled to the electric motor which drives it. This particular machine is at the Huffman dam, but is a duplicate of the pumps in use at Englewood. (The motor in the picture, however, is of 350 horse power as against the 500 horse power motors used at Englewood, the difference being due to the higher head pumped against at Englewood). Such a pump is very simple in its elements;—nothing more than a set of three curved paddles revolving swiftly within an iron shell, sucking very

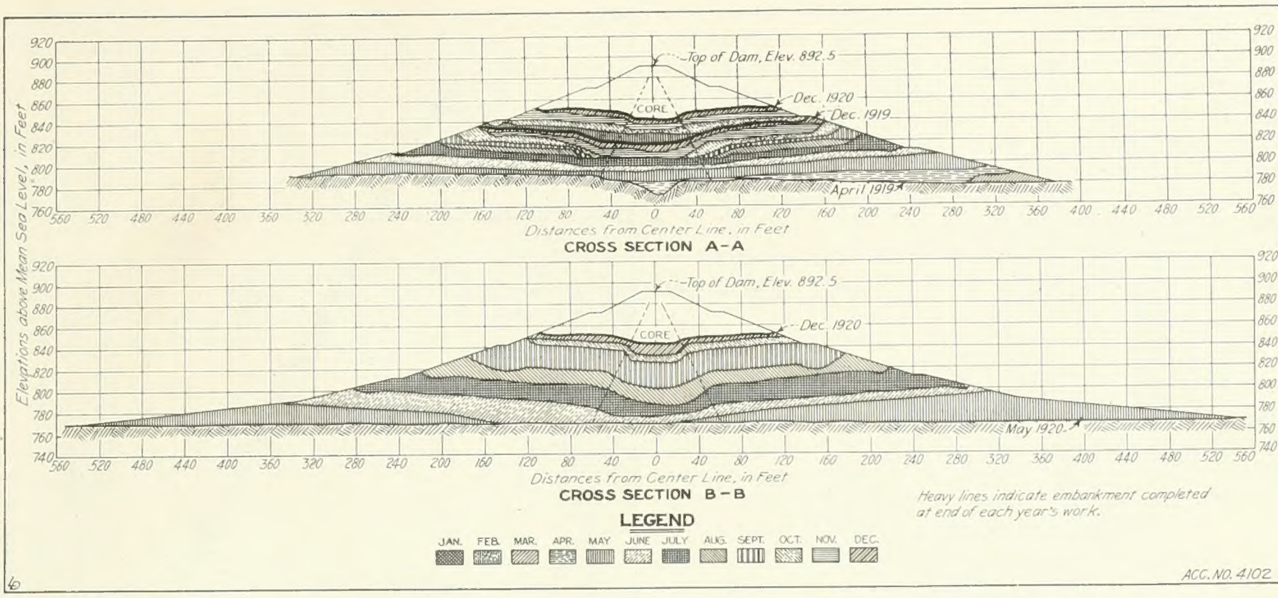

FIG. 278—CROSS SECTIONS, ENGLEWOOD DAM, SHOWING PROGRESS

muddy water in through a pipe at the center of the shell and hurling it out again with great force into another pipe at the shell's periphery. The electric lamp shade hanging beside the pump in the picture will furnish a rough scale of size. The pumps have a nominal capacity of 7,000 gallons per minute, and work up to 150 feet head.

The valley floor to be excavated to furnish materials for the embankment (the excavation and the area to be excavated both being known technically as a "borrow pit"), is shown in its relation to the dam in Fig. 281, reproduced from the Bulletin for November, 1920. The scale of the operations is shown by the small squares, each of which is 500 feet on a side. The extreme limit of the excavation in the borrow pit is thus seen to be more than four-fifths of a mile up the valley from the dam center line. (The boundary of the excavated area being indicated by hatching). A strip next the east bank of the river has been left so as not to interfere with the river's flow. Next east will be seen a long excavated area; then a long narrow unexcavated island and peninsula; then another long excavated area; then a wide unexcavated area running to the east boundary of the map. The first excavated area, nearest the river, was taken out in 1919, together with a

TABLE I.

Earth Placed in Englewood Dam Embankment in Cubic Yards

1919 Month	Hydraulic	Semi-Hyd.	Rolled	Tot. for Mo.	Tot. to Date	Per Cent.
Previous	9,880	49,090	26,100		85,070	2.5
January	2,185	19,100	....	21,285	106,355	3.0
February	....	13,480	....	13,480	119,835	3.3
March	2,445	6,330	....	8,775	128,610	3.6
April	69,900	3,840	....	73,740	202,350	5.6
May	87,700	4,550	....	92,250	294,600	8.2
June	113,180	14,980	....	128,160	422,760	11.8
July	92,870	....	7,540	100,410	523,170	14.6
August	101,900	1,560	9,780	113,240	636,410	17.7
September	93,900	....	2,390	96,290	732,700	20.4
October	98,490	....	4,460	102,950	835,650	23.3
November	103,160	....	4,120	107,280	942,930	26.3
December	58,420	....	810	59,230	1,002,160	27.9
For Year	824,150	63,840	29,100	917,090	....	....
1920						
April	102,750	....	....	102,750	1,104,910	30.3
May	173,760	....	....	173,760	1,278,670	34.6
June	144,550	....	17,700	162,250	1,440,920	40.2
July	153,380	....	5,450	158,830	1,599,750	44.6
August	153,900	....	6,970	160,870	1,764,950*	49.2
September	161,800	....	4,700	166,500	1,931,450	53.8
October	108,270	....	1,240	109,510	2,040,960	56.9
November	143,030	....	2,440	145,470	2,186,430	60.9
December	122,250	....	....	122,250	2,308,680	64.3
For Year	1,263,690	....	38,500	1,302,190	....	....

* Includes 4,330 cubic yards backfilling.

short strip of the second, furnishing in all something less than 900,000 cubic yards of earth materials for the dam embankment. The remainder of the second excavated area (all but the short strip just mentioned), was taken out in 1920, amounting to a little more than 1,300,000 cubic yards delivered into the dam. The dotted lines running down the excavated areas are the abandoned railway tracks used by the dump car trains during the work. The cross hatched lines in the eastern part of the borrow pit are the tracks still in use at the time the map was made (October, 1920.)

The results at the dam are shown in Fig.s 277 and 278, the first giving a longitudinal section and the second two cross sections, the lower one taken through the river section of the dam at BB, the upper one at AA (in Fig. 277), a little east of the river section. In both figures, the cross hatchings indicate progress in successive months, and each year's work is topped by a heavy line of separation. The "legend" in each case gives the key to the months. The cross sections (Fig. 278), show clearly the sag in the center occupied by the core pool, and also the slope of the beaches on each side of the pool, running up to the levees at the tops of the outer slopes. These general lines are followed by each month's deposit of fresh material as shown on the chart. The longitudinal section shows how the cross levees were carried steadily up in advance of the pools that they enclosed, the right levee for the river section of the dam, in 1919, the left levee for the river section in 1920.

Fig. 274 shows the embankment progress in two other ways. The lower part shows the relative quantities deposited in the dam month by month, each vertical rectangle corresponding to one month, and the heights of the rectangles being in proportion to the quantities deposited. A scale to read approximate quantities is given at the left, each horizontal space carried across the diagram corresponding to 10,000 cubic yards of deposited material. The best month is seen to be May, 1920, when 173,760 cubic yards were built into the river section of the dam. The advance in the performance in 1920 as a whole, as compared with 1919, also shows plainly.

The upper part of Fig. 274 shows in its irregular line, marked "actual progress," the total amount of material built into the dam up to any date. The scale at the left is here ten times as great as in the part below, each horizontal space representing 100,000 cubic yards of material deposited in the dam. The time scale is the same as in the lower part of the figure, each vertical space representing one month's time. Thus at the end of 1919, and during the early part of 1920, the line of actual progress becomes horizontal, indicating a stoppage of operations (due to the cold weather), with a total of a million cubic yards of material built into the dam. In the latter part of March, 1920, the line starts up again, with the opening of the new season's work, and in May begins rising rapidly, corresponding to the heavy record noted in the paragraph above. The straight line sloping up to the right, just below the curve of actual progress, is a line of proposed progress, on the supposition that the dam would be completed at the end of 1922 (this being the actual schedule laid out in the headquarters office). It will be noted that the progress for 1919, including the necessary winter shut-down at the end of that year, ends exactly on this line of proposed progress. The record for 1920, however, including the shut-down of the present winter (ending March 1 this year), ends far above the proposed progress line. In fact, if the coming season could show as rapid work as last season did, the Englewood dam embankment would be completed by the end of December, 1921. This will be plain also by comparing the figures in the table on page 119. They show that the total embankment built last season amounted to 1,300,000 cubic yards; and that the total remaining to be done is 1,200,000 yards. It is not to be expected, however, that the present season will equal the last. The low levels, of the dam embankment, the easier parts to pump, are completed; and the higher the dam is pushed, the harder it becomes to push with the old speed, because the material must be pumped against continually higher and higher pressures. The topping out process also, described in the De-

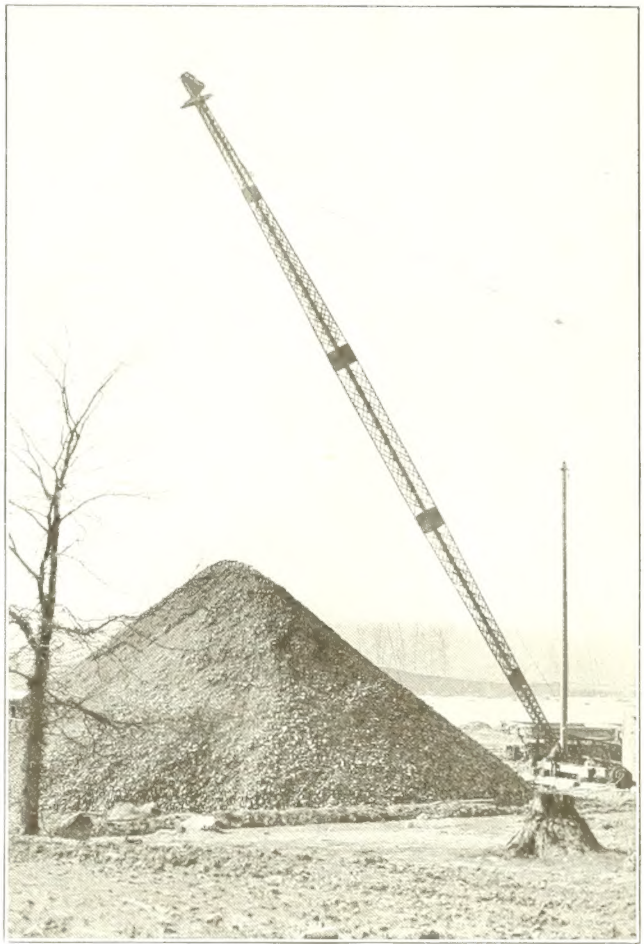

FIG. 279—LOWERING DERRICK MAST, ENGLEWOOD DAM

Taken Feb. 15, 1921. This is a 120 foot steel guy-derrick mast, which has been in use to unload coal for the locomotives transporting materials from the Englewood borrow pit to the dam. It is being taken down to be set up again at the west end of the dam, where it will be used to swing the concrete buckets, etc., in the construction of the new spillway. The foot of the mast is being held firm by a steel cable controlled by the man standing near it, while the top of the mast is being very slowly lowered by means of the compound pulley blocks seen attached near its top.

cember, 1920, Bulletin, takes its additional quota of time which must be reckoned.

The situation of the Englewood dam embankment at a glance is best shown in Fig. 280, where the shaded portions again represent the portions completed month by month, according to the same scheme of cross hatching already noted. The entire "clock-face" shaded would represent the dam entirely finished. The work began in 1918 at "12 o'clock," and the shaded portions grew as indicated, the figures on the clock face margin giving the percentage of the dam completed. December 31, 1919, saw the embankment 27.9 per cent complete. December 31, 1920, saw it 64.3 per cent complete—nearly two-thirds done.

The very creditable speeding up of the 1920 embankment construction is well brought out by a comparison of its high records with those of 1919. In 1919 the high record for a single 10-hour shift was 3,830 cubic yards pumped into the dam, and 7380 cubic yards in 20 hours (two full shifts). This was on September 6 with two pumps in service. In 1920, on April 27, one pump placed 2,808 cubic yards in the dam in 9 hours, 19 minutes. On May 14, one pump placed 4,000 cubic yards in 8 hours, 48 minutes, or 455 cubic yards per hour. On May 28, one pump placed 4,600 cubic yards in 8 hours, 48 minutes, or at the rate of 522 cubic yards per hour. On July 15, 611 dump car loads, equal to 5,500 cubic yards in place in the dam, was pumped into the embankment in a single shift. The best monthly record for the pumps was in May, 1920, the quantity being 173,760 cubic yards.

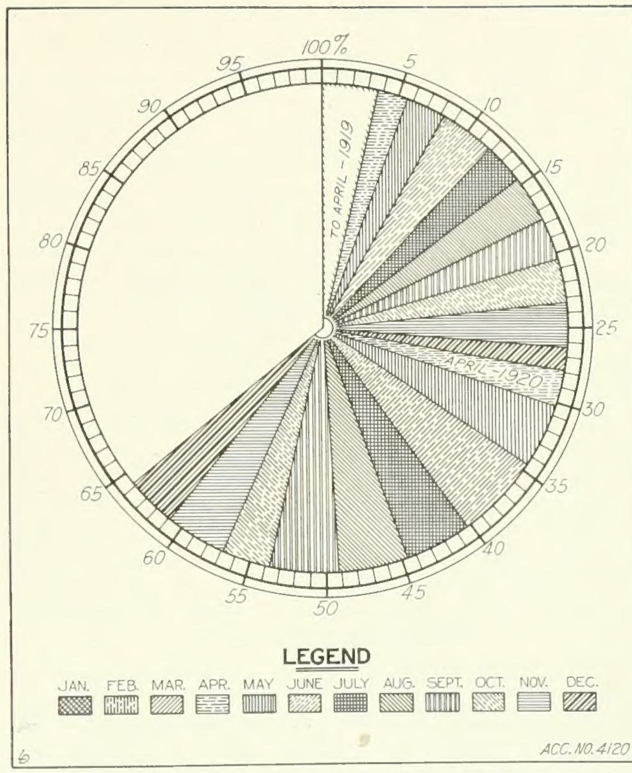

FIG. 280—PROGRESS DIAGRAM, ENGLEWOOD

Showing progress on dam embankment. The shaded parts indicate percentages done during successive months, the various hatchings being given under the "Legend." See page 121.

Shows where the earth was obtained to build the 2,300,000 cubic yards of dam embankment already in place at Englewood. Note the size of the operations, each small square in the plan being 500 feet on a side. Thus the extreme excavation was taken out more than four-fifths of a mile up the valley from the dam center line. (The edges of the excavated areas, which are so marked, are hatched). The left-hand excavated area was taken out in 1919, together with a short strip of the right hand one. Most of the right hand excavated area was taken out in 1920, in amount about 1,300,000 cubic yards. The quantity in 1919 was a little short of 900,000 cubic yards. The dotted lines in the excavated areas are the abandoned railway tracks used in transporting the materials from the borrow pit to the dam. On the unexcavated area at the right these tracks are still in use.

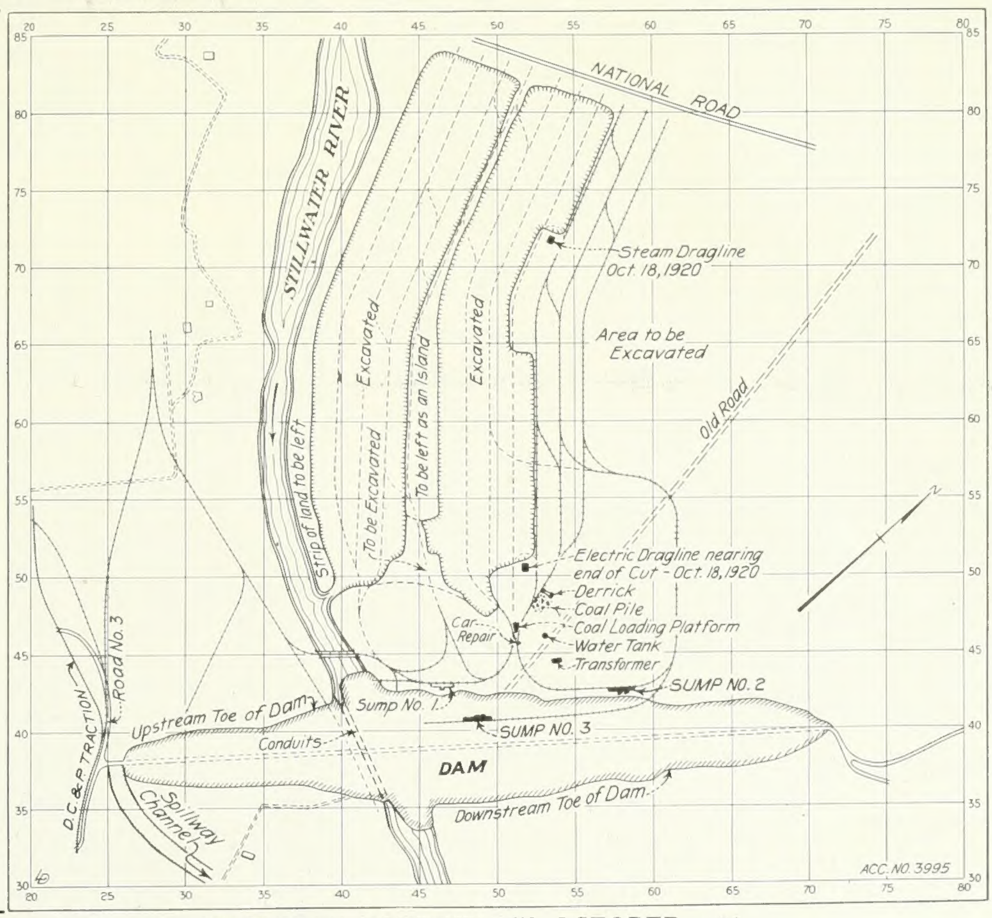

FIG. 281—MAP OF ENGLEWOOD BORROW PIT, OCTOBER, 1920

Such rapid progress as has been evident at the Englewood dam during the season of 1920 comes, of course, only as consequence of continuous, careful and efficient supervision, and the harmonious co-operation of the working staff. The following notes by Mr. H. S. R. McCurdy, the Division Engineer in charge at Englewood, indicate some of the means employed to secure the results noted.

"At all times the plant and equipment are under constant inspection and every effort is made to keep them in a high rate of efficiency. Dragline crews are expected to spend such time each Sunday as is necessary to keep their machines in proper order. (Each machine being in service 20 hours per day through the six-day working week, leaves Sunday the only available time for such adjustment and tuning up). The dump cars are detached from the trains and sent to the yard as they show signs of needing repair. Locomotives are kept in use only while in a condition to render maximum service. As soon as a dredge pump or any part of it shows signs of letting down, replacement is immediately made. A force of expert mechanics and repair men are available at all times for service of this nature; for, with a payroll such as is carired at this dam anything but maximum output is expensive, and a weak piece in the construction equipment can easily throw the working program out of gear, thereby reducing production and correspondingly increasing unit costs."

"Every effort is made to instill into the men a wholesome pride in their achievement, and to create a friendly rivalry between the day and night shifts. Each morning the number of cars of material placed in the dam by the preceding day and night shifts is plotted upon a diagram kept in a conspicuous place. On this diagram is also shown the accumulated total of cars for each shift during the month, as well as the daily averages to date. The highest record for a single shift, for a single pump, for two pumps, for a week, for a month, etc., are conspicuously posted. Also the name of the dragline runner holding the best excavating record is included, together with his best output. These bulletins are matters of lively interest, and are constantly consulted by the workmen vitally concerned, as well as by interested visitors. The average American workman is a good sport; he loves a contest; and whenever he sees a chance to pit his wits and brawn against an antagonist he will put forth his very best efforts to win."

The work at Englewood is under the direction of H. S. R. McCurdy, Division Engineer; H. W. Horne, Assistant Division Engineer; Richard Byers, Superintendent of Construction; Kirby Jones, Assistant Engineer and Inspector; Wm. Pennington, Night Superintendent; and Peter Haskell, Master Mechanic.

January Progress on the Work

GERMANTOWN

Grading the roadway on the top of the dam has been started this last month. The gravel slopes between the top of the dam and the 810 berm have been trimmed to an even grade. The 810 berm, both upstream and downstream, has been graded so that the run-off collected on this berm will drain to the gutters at the center and either end of the dam.

Dismantling has continued throughout the month and at the present writing is practically complete.

The cleaning up of the reservoir above the dam is now in progress. This work consists of felling old trees that are liable to be washed away during high waters and cutting them up in lengths so that they may easily pass through the conduits without danger of clogging them. Also the cleaning up of any rubbish, etc., that obstructs the creek bed.

The wrecking of the camp is continuing at a rate indicating removal at an early date.

A. L. Pauls, Division Engineer.

February 22, 1921.

ENGLEWOOD

The large electric dragline engaged in excavating for the permanent spillway, has temporarily discontinued this work and moved down to the temporary spillway, where it is used for filling with gravel the crib work protecting the downstream spur levee. This work will be completed by February 19 and the dragline will then resume the permanent spillway operations.

Plant repairs and overhauling have proceeded to the point where it is definitely expected to resume pumping operations the latter part of this month. The open winter has greatly favored an early start and it is figured that work this year will be in progress three weeks earlier than was the case last year.

H. S. R. McCurdy, Division Engineer.

February 15, 1921.

LOCKINGTON

A small amount of work has been continued on the stone surfaces of the dam, stone being hauled to such places as will be difficult of access after the dredge pipes have been laid in position for use. Some stone has been laid on the west slope of the outlet channel.

All the dredge pipes have been repaired. Patches and lugs have been welded to the pipe and some split seams rewelded.

The drilling and blasting of the clay portions of the borrow pit have been continued.

The electrical equipment is being put into shape and the line from Piqua changed back to 33,000 volts for resuming the pumping operations on the first of March.

Barton M. Jones, Division Engineer.

February 23, 1921.

TAYLORSVILLE

The progress on the excavation from the outlet channel has been very satisfactory. It now appears that the temporary channel that is being excavated along the east half of the outlet channel will be finished by April 15, which is well up to schedule. This will permit the old river channel to be closed as soon as the danger from spring floods is past, following which pumping of the river section of the dam will begin.

The dredge pumps have been repaired and pipe lines repaired and relaid where necessary and we expect to start pumping February 24. Pumping will be continued into that portion of the dam west of the cross dike until such time as the old river channel is closed.

The weather has not permitted any further work on Road 12.

O. N. Floyd, Division Engineer.

February 23, 1921.

HUFFMAN

The pumping of material into the embankment of the dam has been in progress until February 10th. On that date the work was closed down in order to do some necessary repair work on the electric dragline and to move the booster pump up the slope of the dam to elevation 815, which is sixteen feet above the first set up. This work has been completed, and pumping was continued on February 21st.

All the available material in the upper part of the borrow pit on the hillside at the north end of the dam has been taken out. The remaining part of the material to be obtained from this pit is at too low an elevation to be washed directly into the dam by gravity alone, as has been done to

date. A standard 15" dredge pump is being installed in the sluice line to act as a booster to assist in lifting this material into place on the dam. This unit will be in operation again the first of March.

The steam dragline is taking out the remainder of the earth coffer dam across the outlet channel below the concrete outlet works, and giving this channel its final shaping up.

C. C. Chambers, Division Engineer.

February 22, 1921.

DAYTON

Progress has been slow during the past month owing to several rises in the river stage.

Dragline D16-15 has continued river excavation below Stewart Street. D16-16 has done the necessary trench work for lowering the easterly half of the 24" water main above Fifth Street bridge, and has cleaned up part of the debris left by the bridge building contractors in 1916. D16-8 has completed its work at the mouth of Wolf Creek and is being dismantled. It will be erected again below the Big Four railroad bridge near Miller's Ford. D16-19 is undergoing repairs. The steamboat machinery has been dismantled.

Ohio Street and Grant Street walls have been completed. The land along the Delco-Light Company property on the south bank of Mad River and the southwesterly wing wall for Keowee Street bridge are under construction. Work is being resumed on the river walls at Beach Avenue and First Street and excavation is under way for the river wall west of Main street bridge.

The gravel plant is again operating. The total quantity of sand and gravel issued to date is 59,100 cubic yards. A steel stiff-leg derrick has been installed for use in feeding the stock gravel to the plant.

Construction work is being installed for the work to be done along Wolf Creek.

The Finke Engineering Co. is placing concrete in the Apple Street culvert. Price Brothers Co. is continuing the removal of the old stone wall at Keowee Street on the north bank of Mad River. J. C. McCann completed about 6000 cubic yards of excavation from Mad River channel previous to February 1.

The total quantity of channel excavation (Item 9) up to February 1 was 903,500 cubic yards, and 173,000 cubic yards of levee embankment has been placed. The total yardage handled was 1,980,000 cubic yards. None of the figures include 105,000 cubic yards of excess excavation for scowing canals.

C. A. Bock, Division Engineer.

February 23, 1921.

HAMILTON

The west bank above the Columbia bridge is being finished by the electric dragline D-16-18. The total of Item 9, channel excavation, to February 1 was 861,700 cubic yards.

At the Black Street bridge the mass concrete in the west abutment has been completed, and the spandrel walls and counterforts are being poured. The Bucyrus Class 14 dragline has moved across the river and completed the excavation for Pier No. 1. It is now ready to drive the piling.

Excavation has been continued at the Black-Clawson wall and piling are being driven in the portion excavated to grade.

Top soil has been placed on the completed banks between Main Street and the Columbia bridge.

Several sewer outlets on the west bank are being extended to the line of the concrete slope revetment.

C. H. Eiffert, Division Engineer.

February 22, 1921.

UPPER RIVER WORK

During the last month, the dragline (D-16-21), at work on the Donald Jeffrey Contract, brought its total river excavation to 27,000 cubic yards. This work was completed the first part of the month, and since then the dragline has moved into position, about 800 feet above Adams Street, to place the embankment for the levee extending from Adams Street to a point opposite the entrance to Riverside Cemetery. To date about 7,000 cubic yards of material has been placed in this levee.

The C. & C. Haulage Co. has continued its work between Market Street and the B. & O. Railroad. A third Osgood shovel has been added to their equipment. Their total excavation amounts to 75,000 cubic yards.

On February 22nd the C. & C. Haulage Co. started the excavation for the north abutment of the new span of the Market Street Bridge. The gravel and lumber for the abutment is at hand and the forms will be started as soon as the excavation is complete.

Weather conditions have continued troublesome to the progress of the work near Morgan Ditch. The total levee embankment for the Finke Engineering Co. amounts to 27,800 cubic yards and the street fills contain 2,800 cubic yards. The Harrison Street approach to Morgan Ditch has been completed except for the gravel roadway, and also the Atlantic Street approaches to Harrison Street.

The house belonging to the District, and known as the "Briggs House," has been moved from its former location at the north end of Market Street Bridge, to its new location on one of the lots made by the spoil bank on the west side of Market Street. This work was done by Chas. E. Foreman of Dayton.

The storm sewers entering the river at the street ends between Market and Adams Streets are being extended down the slope and out towards the new toe of slope of the levee that will be constructed on the right bank of the river. The C. & C. Haulage Co. has already started this embankment at the north end of Short Street.

A. F. Griffin, Assistant Engineer.

February 24, 1921.

LOWER RIVER WORK

Miamisburg—Since our last report, Cole Bros. have constructed the levee along the north side of Sycamore Creek between Fourth Street and the Big Four R. R., and along the south side from the alley east of Fourth Street to the railroad. Wet weather caused three days' delay and moving and repairs to the machine occupied five days. The dragline will now be moved to the extreme southern end of the work and levee construction will proceed northward. Cole Bros. are making this move in order to keep the machine working on comparatively high ground, which prevails below Linden Avenue, during the next two months, as more or less high water may reasonably be expected at this time. The work above Linden Avenue, which requires putting the machine down into the river bed, will thus be left for the dryer summer months.

Franklin—The dragline, D-16-10, has been limbered up and after undergoing a few repairs has commenced excavating for the conduits for the tail race of the American Writing Paper Co. When this is done the machine will cross the tail race and excavate a temporary channel to handle the water during construction of the conduits. The present channel will simply be widened and a cofferdam constructed around the excavation for the concrete work. A good start has been made on trestle construction for levee embankment and the narrow gage locomotives are being fitted up and made ready for use. Guard rail construction on the west side has been completed with the exception of painting. The engineers' office has been moved from the downtown location to the temporary building erected at the intersection of Bridge Street and Van Horne Avenue, which is one square west of the Dixie Highway and just north of the "Harding" mill.

Middletown—Since our last report, Price Bros. have poured 464 lineal feet of the Hydraulic Street wall. Top soil is being hauled on to the levee between Milburn Avenue and the canal bridge at the west end of Tytus Avenue.

F. G. Blackwell, Assistant Engineer.

February 23, 1921.

RAILWAY RELOCATION

Big Four and Erie—Mr. M. K. Frank has removed all of the rail and bridges from the Erie Line, which work was completed the first week in February. The Big Four started removing the rail off the old Big Four line Tuesday, February 15. The District forces are removing the salvageable material that remains. The old ties are being shipped to other features of the District.

Ohio Electric Railway—The bonding is not completed and diversion of traffic will be deferred until this work is completed, which will be about March 1st. Mr. Joseph Connelly was awarded the contract for the grading of about 4000 cubic yards of earth at Mud Run bridge, just east of Osborne. This work was left uncompleted at the time the regular grading for the Ohio Electric was done,

course of interference with the old Big Four and Erie railroads. As these roads are now out of service the work of closing the gap was started on February 14th.

Baltimore & Ohio Railway. Work completed.

Albert Larsen, Division Engineer.

February 23, 1921.

RIVER AND WEATHER CONDITIONS

No floods of any importance occurred during the month of January, although small rises of from two to five feet occurred on the ninth and again on the thirty-first. At the District's stations the total rainfall for the month varied from [illegible] inches at [illegible] to 2.91 at the Germantown Dam. At Dayton the total amounted to 2.59 inches, or 0.42 inches less than normal.

The local Weather Bureau records show that the mean temperature for the month was 35 degrees, or 5 degrees greater than normal, that there were 11 clear days, 6 partly cloudy days, 14 cloudy days, and 9 days on which the precipitation amounted to 0.01 of an inch, that the average wind velocity was 11.9 miles per hour, the prevailing direction being from the southwest, and that the maximum wind velocity for five minutes was 37 miles per hour from the northwest on the 16th.

Ivan E. Houk, District Forecaster.

February 25, 1921.

Old Hollow Headed Rail Found on Harshman Siding

Interesting Pear-Shaped Sections Rolled Before Steel Came Into Use.

An interesting circumstance in connection with the wrecking of the old Big Four R. R. line, following the relocation, was the discovery of two pieces of "prehistoric" rail in use in the Harshman Siding, three miles northeast of Dayton. This siding served an old mill, still standing, dating back into the fifties of the last century. Near the end of the siding a few short lengths of light rail were found with a pear shaped head instead of the T head now in use. Inspection showed that in addition to its peculiar shape, one of these old rails had a hollow head, as shown in Fig. 282. This picture is taken from a "sulphur print," kindly furnished by the Hunt Inspection Bureau of Chicago, who were good enough to make an examination and analysis of a section of the old rail sent them. The end of the rail was polished. A piece of photographic paper was then dipped in a dilute solution of sulphuric acid and laid on the polished face of the rail for a short time (the period being usually about one minute). The parts of the steel higher in sulphur left a darker impression on the photographic paper than those parts lower in sulphur. Thus the "sulphur print" shows in a rough way the distribution of sulphur in the specimen, this element being one of the most deleterious impurities. This action shows plainly in Fig. 282, the base and web of the rail appearing much darker than the head, indicating that the latter, which in service took the wear, was of much purer matter. Besides furnishing the sulphur print, the rail was analyzed chemically.

The etching and analysis both show that the pear-headed rail is of iron and dates back to the old days before steel had taken the place of the earlier used material. The transition began about 1865 and was brought about by the wearing qualities of steel under the increasing severity of the hammering and mashing action of car wheels on the rail head, this being due in turn to the steadily increasing weight of locomotives and cars.

Thus the chemical analysis carries the date of the rail back to 1865 or earlier. The shape carries it still further back, to 1859 or 1860. This is shown by records of the Cambria Iron Company at Johnstown, Pa., given in the upper part of Fig. 283. This series shows the shapes of the successive grooves of the rolls through which the redhot iron "bloom" or billet was passed in the mill to bring it to the final rail shape. These successive grooves are numbered "1, 2, 3, 4, 5," the last showing the identical pear-shaped hollow head found in the Harshman Siding. The date of the record is 1859.

This information was furnished by Mr. G. B. Waterhouse, Metallurgical and Inspecting Engineer for the Lackawanna Steel Company of Buffalo, N. Y., to whom also sections both of the solid and hollow headed rail were sent.

The lower set of shapes in Fig. 283, also kindly furnished by Mr. Waterhouse, show the successive rail shapes used on American railways, from the beginning (on horse drawn tram lines) in 1808, up to the present time. Development in size is shown as well as in shape, the rail at the right (1910 model) being $6\frac{1}{2}$ inches high. The hollow pear head appears in this series, dated 1860.

It is interesting to note in this development that in 1831 a T headed, broad based rail, [illegible]

FIG. 282—SULPHUR PRINT OF OLD RAIL, DEC. 1920

This curious hollow-headed old rail was taken from the Harshman Siding of the Big Four R. R. near Dayton, where it was probably originally laid about 1860. It was rolled by the Cambria Iron Works of Pennsylvania, as roll records in their mill show, the metal being iron instead of steel, the latter metal not coming into use till 1865. The head was rolled hollow to save about 10 per cent in metal. The pear-shaped head is to reinforce the web of the rail against its tendency to bend, and thus permit one side of the head to lop down. See page 124.

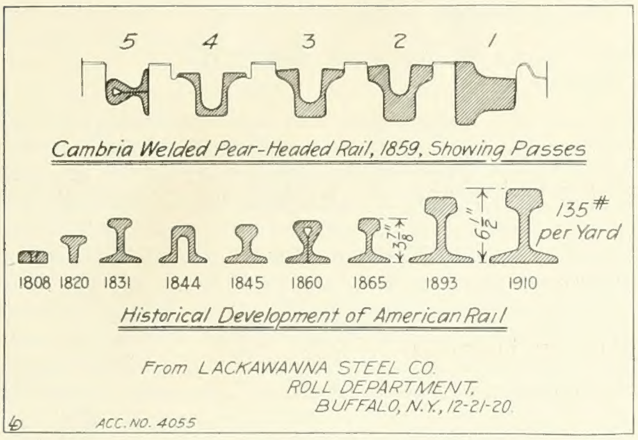

FIG. 283—PASSES USED IN ROLLING OLD RAIL

cally its present shape, had been already reached. The U-shaped and pear shaped sections, competing "Darwinian variations" which sprang up later, went to the wall in the struggle for existence where only the fittest survive. The reason for both the U-shape and the pear shape was evidently to support the edges of the rail head against the tendency to buckle or mash down under pressure of the car wheel tread. With iron, which is much softer than steel, this support was necessary, as all the sections in Fig. 283 between 1831 and 1865 show. In all these we see the broad supporting base and the somewhat narrower head, connected by a shape built stiffer than the present narrow vertical web. With the coming in of steel, a more rigid material, in 1865, these stiffer shapes were no longer necessary and to save metal were discarded.

It is interesting to note that the use of the hollow head, as in the Harshman rail, was also to save metal, the amount saved being about 10 per cent. The metal was saved at some excess labor cost for rolling the rail head hollow, indicating a relatively low labor cost at this period of manufacture.

It will be understood that the historical development shown in Fig. 283, gives dates of introduction of the several shapes. In actual use, of course, the older forms survived many years (as in the Harshman siding), gradually disappearing, and finally becoming extinct.

The Bulletin wishes to acknowledge, in addition to those mentioned, the kindness of Mr. E. T. Howson, Western Editor of The Railway Age, of Mr. C. W. Sennet, Jr., of the C. W. Hunt Co., of Mr. A. J. Sebastian of the Cincinnati Iron & Steel Co., and of Messrs. Albert Larsen, Division Engineer, and Fowler S. Smith, Purchasing Agent, of The Miami Conservancy District, in securing the information here presented.

We append Mr. Waterhouse's letter as giving some additional interesting technical matter.

The two specimens of old rails taken from a switch leading from the Mad River (Miami Conservancy District, Dayton, Ohio,) have been carefully examined.

One is a solid pear-shaped rail, and in its present condition weighs 57.6 lbs. per yard, the other is a hollow pear-shaped section and weighs 54.6 lbs. per yard.

Both rails proved to be made of wrought iron, and so are of the class of material in general use before Bessemer steel rails were made. The results of analysis were:

	Carbon	Manganese	Phosphorus	Sulphur	Silicon
Solid Rail	0.04%	0.025%	0.552%	0.067%	0.212%
Hollow Rail	0.03	0.013	0.254	0.209	0.184
Hollow Rail*	0.005	0.085	0.49		

In order to show the difference between this and present day material, below are given typical analyses of Bessemer and Open Hearth steel, such as would be used in a 60-lb. rail.

	Carbon	Manganese	Phosphorus	Sulphur	Silicon
Open Hearth	0.57%	0.75%	0.035%	0.055%	0.12%
Bessemer	0.42	0.95	0.10	0.070	0.12

Our Roll Shop Department has investigated the rolling of these two sections. The hollow pear-shaped rail was undoubtedly rolled by the Cambria Iron Company at Johnstown, Pa., about 1860. A sketch of the roll grooves for this section, as found among the old records at Cambria, is given on the accompanying blue print. There is a tradition that this hollow-headed rail was rolled at a time when the size of rail, and not the weight, was specified. The hollow place reduced the amount of metal by about 10 per cent.

The solid rail is a good example of the pear-shaped iron rails rolled at a number of places in this country from 1845 to about 1860. The so-called strap rails were discontinued about 1844. The first T-rails were designed by Robert L. Stevens, Chief Engineer, Camden and Amboy Railroad. They were 36 and 40 lbs. per yard, and rails of this kind were apparently first rolled in 1845 at the Montour Rolling Mill, Danville, Pa. The pear shape was used because it provided metal to support the sides of the head, and prevent them breaking down. The use of steel in place of iron for rails commenced about 1865, and the new design of rails from which our present sections were developed was worked out by Mr. Ashbel in 1866.

Steel became necessary because the iron rails gave very poor service as traffic and the weight of rolling stock increased. Because of lack of homogeneous material and uniformity the iron rails scaled, splintered, laminated or else disintegrated and mashed down in spots before they wore out. A brief historical development of rails in this country is shown on the same blue print as the roll passes for the old hollow rail.

Electrical vs. Steam Dragline Excavator

The dragline excavator shown operating in the Englewood borrow pit in the picture on our front outside cover, is an electrical machine. The machine seen in the distance in the same picture is a machine identical in size and equipment except that its motive power is steam instead of electricity. These machines have worked at Englewood under similar conditions, digging similar materials, for the past two seasons. A comparison of the machines, as to efficiency, etc., under these circumstances, will be published in an early Bulletin.

*This third line shows the analysis of the hollow headed rail by C. W. Hunt & Co., the metal in this case being taken from the head of the rail, the upper analyses being of metal taken over the entire rail section. The difference corroborates the testimony of the sulphur print in indicating that the head of the rail is of purer metal.

The Cableway Used at Black Street Bridge

Three-Ton Cableway Stretched Between 80-Foot Towers 800 Feet Apart Handles All Construction Material.

Space in last month's Bulletin did not permit a sufficient account of the cableway used at Black Street bridge; hence the present article.

The general view of the cableway is shown in Fig. 285. A heavy suspension or trolley cable of steel wire is stretched between the timber towers, one on either shore of the river. On this cable a carriage runs, shown near the right-hand tower in Fig. 285, and in larger detail in Fig. 284. (The two views being taken from opposite sides of the cableway). This carriage is drawn back and forth by means of another (the conveying) cable. (The lower one in Fig. 284, the heavy cable being the suspension or trolley cable). The carriage carries a bucket hanging by a third cable (the hoist cable), by which the bucket is raised and lowered. The conveying cable and the hoist cable are both actuated by means of a hoist engine in a little house behind the "head tower" (the left (east) tower in Fig. 285, the right tower being the "tail tower.")

The conveyor cable is virtually an endless cable with the carriage lashed to it at one point. It passes from the carriage to a sheave on the "tail tower;" thence to a sheave on the "head tower;" thence to and around the engine drum (the conveyor drum); thence back over a sheave on the head tower to the carriage. Thus, rotating the conveyor drum pulls the carriage along the suspension cable. Reversing the rotation reverses the direction of the carriage's motion.

The hoist cable passes from the bucket up over sheaves on the carriage directly to a sheave on the head tower and thence down and around a second drum (the hoist drum), of the same size as the conveyor drum and mounted beside the latter on the same shaft. When pulling the carriage along the suspension cable the two drums are locked together and act as one. The conveyor and hoist cables also act as one (since the two drums are of the same diameter); and the bucket therefore hangs at a constant distance below the carriage during the latter's travel. When the carriage stops over the concrete hopper at the work, the hoist drum is unlocked from the conveyor drum, and rotates independently, unwinding the hoist cable and thus lowering the bucket. Reverse rotation raises the bucket.

Details are shown in Fig. 284, except that the upper portion of the endless cable—the cable which pulls the carriage to and fro—does not appear in it, as will be clear on comparing the carriage in Fig. 285. The lower part of the endless cable is the lower wire of Fig. 284; the heavy wire is the suspension cable, on which the carriage runs by means of the three middle wheels. The two lower wheels are sheaves carrying the hoist cable; the latter being "becketed" to the bucket sheave; thence passing up over the left lower carriage wheel, thence down around the bucket sheave; thence up over the right lower carriage wheel to the head tower and down to the engine drum, (it being the cable between the heavy cable and the lower cable at the right in Fig. 284.)

The upper cable in Fig. 284 is the "button line," the vital part of a necessary mechanism for supporting the hoist cable and the lower loop of the conveyor cable as the carriage runs out toward the tail tower. The two towers at Hamilton are 800 feet apart. With the carriage in the position shown in Fig. 285 (the tail tower being at the right), there would be nearly 800 feet of unsupported hoist cable, and the same length of conveyor cable, between the carriage and the head tower at the left. Without support, these cables would sag so low in the center that they would interfere with the work below. A cable (the "button line") is therefore stretched

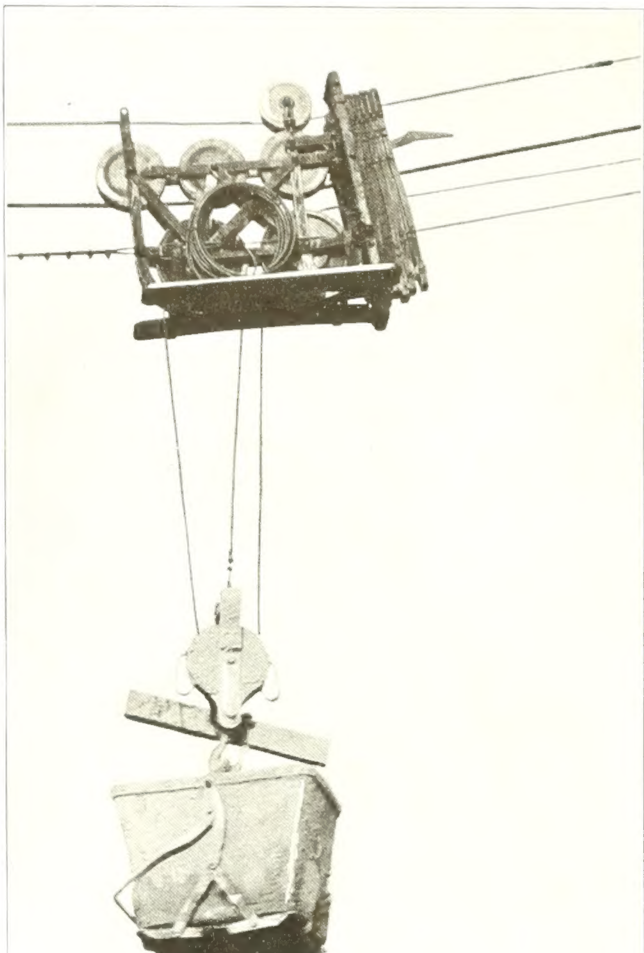

FIG. 284—CABLEWAY CARRIAGE AND BUCKET

The carriage rides on the heavy cable (the suspension cable; see also Fig. 284), on the middle row of three wheels carrying with it the hook and concrete bucket below. It is pulled back and forth by the lower cable (the conveyor cable). The bucket is raised and lowered by means of the hoist cable (next the bottom cable at the right, and passing also round the bucket pulley below). The upper line is the "button line," used to support the hoist and conveyor cables by means of slotted steel bars. (Four of these may be seen supporting these cables in Fig. 284). The suspension cable and button line are both anchored at each end to timber towers ("head tower," "tail tower,") on either shore. The hoist and conveyor cables are actuated by a hoist engine near the head tower. See page 126. Taken January 27, 1921.

between the two towers, just above the main suspension cable. (It is the upper line in Fig. 284). "Fall rope carriers"—slotted steel bars—are hung on this "button line," and the two sagging cables passed through their slots. Four of these "rope carriers" may be seen in Fig. 285, hanging from the button line at equidistant points along its length, and supporting the conveyor and hoist cables below. As the carriage runs back toward the head tower it picks these carriers up, "spearing" them with the horn or spear point seen projecting at the right of the carriage in Fig. 284. This figure in fact shows the four carriers "speared," and hanging from the button line, just behind the horn. (There are in fact five carriers, the fifth being supernumerary, for use with longer spans than the 800 ft. at Black Street). The carriers are picked off the carriage as it runs out (running toward the left in Fig. 284), by means of metal "buttons fastened to the button line at proper intervals (one is shown at the extreme right in Fig. 284). These buttons are of progressively larger and larger diameter toward the tail tower, and thus pick off the carriers, one after the other, by means of eyes at the upper end of the carriers, these eyes being also of progressively larger and larger diameter and each threaded by the smaller buttons till its proper button arrives.

For work like bridge construction, where the lay out is long and narrow, the advantage of such a cableway as that described is obvious. It can distribute materials at or close to any part of the work, including not only concrete, but steel reinforcement, motors, pumps, timbers, form lumber, forms, or any other necessity. By stiffening the tower structures, and mounting them on wheels running on parallel railways at right angles to the cables, the entire mechanism can be moved along so that materials can be delivered over a wide area, after the manner of a travelling crane. At Hamilton this more expensive extension was not necessary.

The cableway at Hamilton was built by the Lidgerwood Company and is of 3 tons capacity. The main cable is 1½" diameter, the conveyor line ¾", the button line ¾", and the hoist line ½" diameter. All the cables are of steel wire. The hoist engines are actuated by steam, fed by a 60 horsepower boiler. The two timber towers are simple "A-frames," 80 ft. high and 800 apart. The working of the cableway on the Black Street work has been very satisfactory.

The work at Hamilton, including the Black Street bridge, is under the direction of C. H. Eiffert, Division Engineer, R. B. McWhorter, Assistant Division Engineer; W. T. Rains, Supt. of Excavation; W. A. Roush, Supt. of Concrete Work; G. W. Schrader, Inspector. The bridge was designed by R. M. Riegel, Designing Engineer for the District.

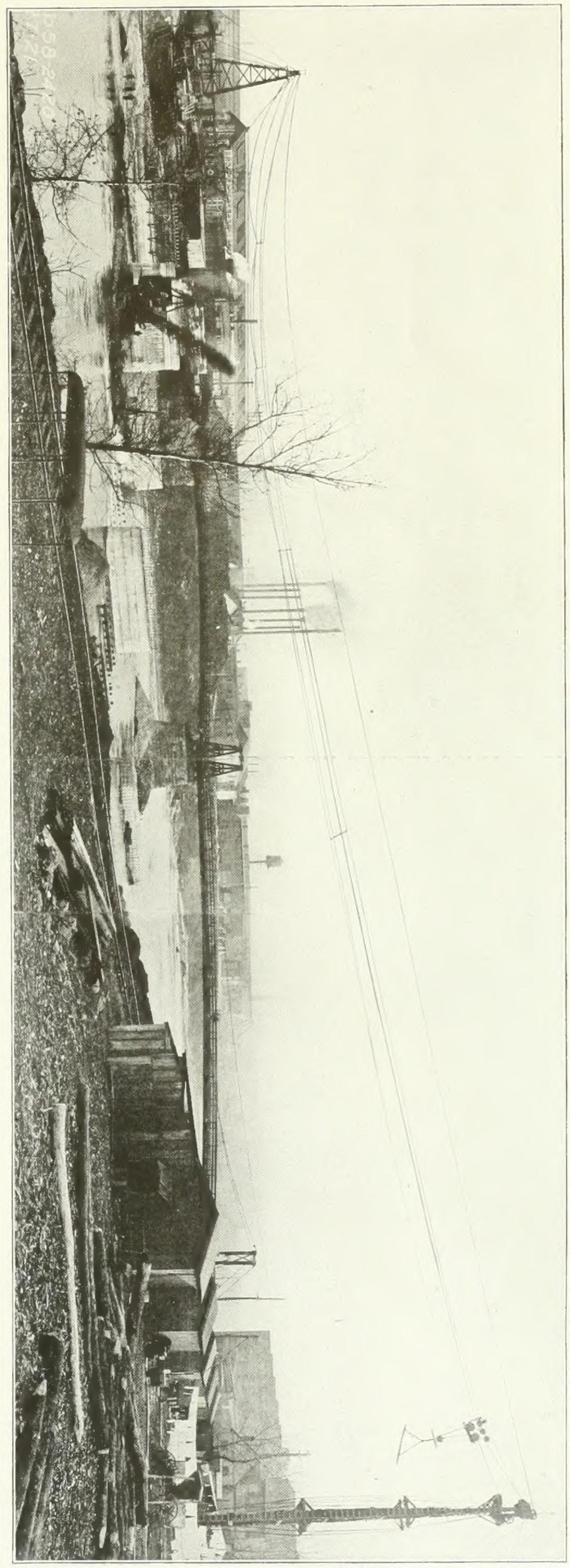

FIG. 285—LIDGERWOOD CABLEWAY DISTRIBUTING CONSTRUCTION MATERIALS, BLACK STREET BRIDGE, HAMILTON, JAN. 27, 1921

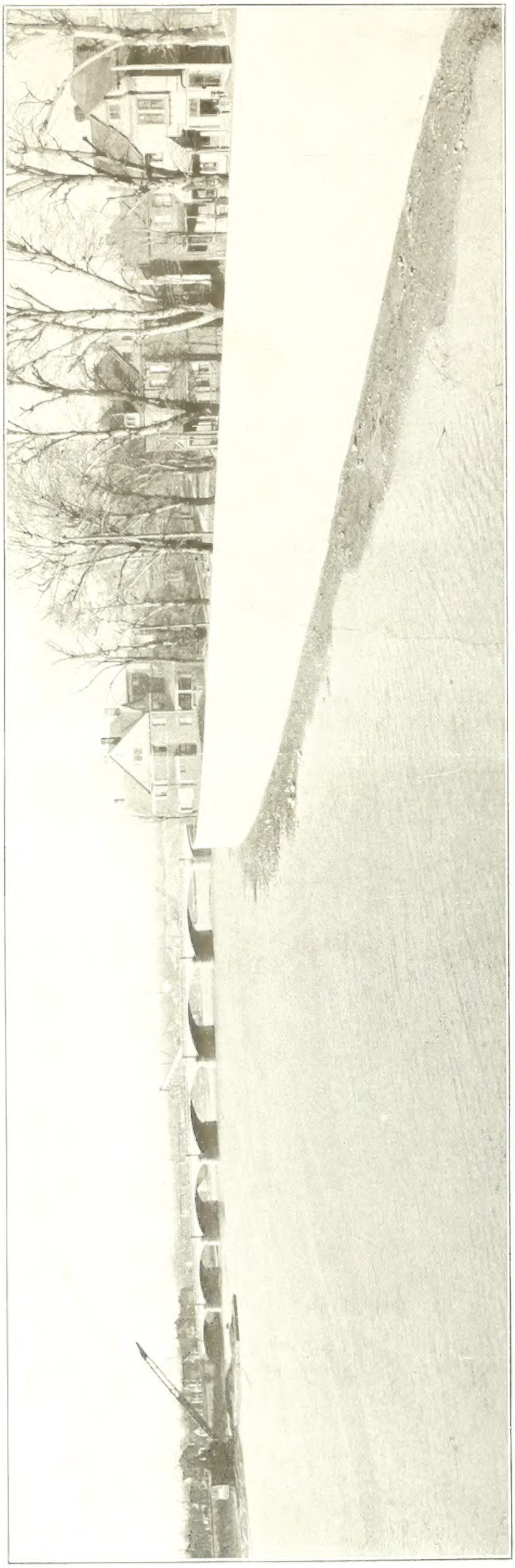

FIG. 286—ROBERT BOULEVARD WALL, DAYTON, JANUARY 12, 1921

A View of Robert Boulevard Wall

We present on this page (Fig. 286), a view of Robert Boulevard wall in Dayton, in its finished condition. This is of interest as being typical of the concrete walls built in several places to take the place of the usual levees, when the latter would have encroached too much on valuable river bank property, owing to the space taken by their wide slopes. A description of the construction of the wall here shown was given in the Bulletin for March, 1920. Its total length is 1036.4 feet, extending from Third to Fifth Streets on the left bank of the river. Its total height, including the base, is 25 feet, of which 20 feet, 8½ inches is wall proper, the remainder being below ground. The base is 12 feet, 4½ inches thick; the wall proper 5 feet, 4 inches thick at the bottom and 12 inches at the top. It contains 4,500 cubic yards of concrete. It was begun in October, 1919, and finished in August, 1920. To build it five dwelling houses had to be wrecked. The picture was taken from Fifth Street bridge, and shows Third Street bridge in the distance, with one of the large dragline excavators engaged in loading a scow with some of the last of the material to be excavated above Fifth Street.

Review of Conservancy Technical Report, Part VII

(Continued from Page 116)

tions. In order to make the book more complete some matter more or less generally known has been included.

Chapter II, which follows the introductory chapter, contains valuable data relating to storm rainfall and flood runoff. The great flood of March, 1913, the earlier floods in the Miami Valley, a few long records of floods in European rivers, and the great storms which have occurred in the eastern half of the United States in the last half century, are all discussed with reference to the Miami problem.

Chapter III is principally descriptive. It will be interesting to engineers who wish to obtain a bird's-eye view of the Miami Valley and the works being constructed therein. The description is supplemented by a lengthy table of existing flood control reservoirs, of which 45 are in Europe, 1 in India and 10 in the United States.

With the exceptions of Chapters X and XIII, which deal with the action of the reservoirs during localized cloudbursts and the alternative flood protection plans, respectively, the remaining chapters contain the information most valuable to hydraulic engineers. These take up the methods used in solving the numerous hydraulic problems connected with the work, and also the general hydraulic principles followed in the channel improvement designs. The greater part of this material can be readily followed by most engineers, but in one or two cases, such as the treatment of spillway operation, the mathematics is of such a nature as to appeal only to mathematicians. Probably the parts dealing with the flow through the outlet conduits and the design of river channels will be referred to most.

It is believed that the book as a whole will prove unusually valuable to engineers engaged on flood protection work. Had such a volume been available when the Miami Conservancy work was started much time and money would have been saved.